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ABSTRACT

REQUIREMENTS AND PLANNING GUIDELINES FOR INDUSTRIAL ARTS FACILITIES ARE OUTLINED FOR APPLICATION TO THREE TYPES OF INDUSTRIAL ARTS SHOPS. THE RATIOS OF AREAS TO STUDENTS ARE DISCUSSED IN REGARD TO THE SIZES, SHAPES, AND LOCATIONS OF SHOPS. SPECIFICATIONS FOR WALLS, FLOORS, CEILINGS, WINDOWS, PAINT, AND ILLUMINATION ARE INCLUDED. AN EQUIPMENT CHECKLIST IS GIVEN ALONG WITH FLOOR PLANS AND CHARTS. (TG)

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Industrial Arts Facilities

From the "Guide for Planning and Construction of School Facilities in Georgia,"

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Jack P. Nix, State Superintendent of Schools . . . . . .Georgia Department of Education

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Industrial Arts Facilities

DIVISION OF VOCATIONAL EDUCATION
OFFICE OF INSTRUCTIONAL SERVICES
GEORGIA DEPARTMENT OF EDUCATION

JACK P. NIX, STATE SUPERINTENDENT OF SCHOOLS
1969

INDUSTRIAL ARTS FACILITIES

Industrial Arts is a planned program of educational experiences requiring special facilities. The terms unit, limited general and comprehensive general are used to describe three major types of shop organization housed in these facilities.

Bases for Facility Selection

The organization of each industrial arts shop (including classrooms, drafting rooms and laboratories) is influenced directly by the nature of the instruction and the stated objectives of the program. If the major objective is to provide a broad, industrial-technical exploratory type of program with emphasis on basic experiences and understanding related to industry, the shop should provide for experiences in several industrial arts instructional areas; the facility is organized as a comprehensive general shop. When the major objective is to provide a more concentrated emphasis, the course content is limited to a single area (such as general drafting) of industrial arts. A facility organized for instruction in a single general instructional area is a limited general shop.

At the high school level, in a school in a small community that does not have sufficient enrollment to justify a series of limited general shops, it is more feasible to provide a comprehensive general shop. In larger high schools, the industrial arts facilities should consist of several limited general shops.

Comprehensive General Shop

A comprehensive general shop is organized and equipped to provide industrial-technical experiences which have been selected from a variety of activities in two or more instructional areas of industrial arts. The comprehensive general shop should have provisions for instruction in several areas such as drafting, electricity-electronics, metals, woods, power, and graphic arts.

The Limited General Shop

An industrial arts shop organized and equipped to provide instruction in two or more subareas of a single industrial arts instructional area is the limited general shop. As an example, a limited general shop in the area of graphic arts includes subareas such as bookbinding, linoleum block printing and offset printing.

The Unit Shop

An industrial arts shop organized and equipped for a single subarea of instruction such as cabinetmaking, machine shop or sheet metal is the unit shop. The major function of this type of organization is to provide a concentration in one industrial arts

subarea. Note: This facility is generally not recommended in Georgia except as a part of the limited general shop or the comprehensive shop.

School Organization

Junior High School - This type of school should contain one or more laboratory units providing for at least four of six areas of instruction (drafting, woods, metals, electricity, power, graphic arts). The instruction can be organized either in one laboratory or divided between or among two or more laboratories. When two or more laboratories are available, the pupils are scheduled through these laboratories to complete the industrial arts exploratory course (general industrial arts).

Senior High School - These schools are usually large enough to require two or more laboratory facilities. Frequently, more than four laboratory facilities are provided in large cities. A department with only two laboratory facilities should have each laboratory equipped for two areas of instruction, and a four facility department would have each equipped for one instructional area. These instructional areas are general area courses which provide depth instruction as well as special courses in industrial arts education.

Junior-Senior High School - This type of school may include one or more laboratory units which are used for both junior and senior high school courses. A small school with a minimum laboratory and one teacher should be equipped for the general industrial arts course which provides for at least four of six areas of instruction (drafting, woods, metals, electricity, power, and graphic arts). The minimum facility should also be designed and provide for at least one of the general area courses such as general drafting, general metal, etc. The adjoining planning-drafting room should be of sufficient size (850 square feet minimum) to accommodate equipment and drafting desk for a general course in drafting.

In larger schools where two or more laboratories are required, four to six of the basic areas of instruction described for the minimum laboratory should be organized among these laboratories. These facilities should also provide for three or more general area courses.

Number of Shops Needed

Basic assumption used in determining the number of laboratory units needed are as follows:

Grades 7 and 8

24 pupils per class (maximum)
5 periods per week for 18 weeks (grade 7 and 8) or
5 periods per week for 36 weeks (grade 8)

Grades 9-12

24 pupils per class (maximum)
5 periods per week for 36 weeks

Grade 9: 30% of the pupils (60% of boys) enrolled
Grades 10-12: 15% of the pupils (30% of boys) enrolled

Typical problem: How many laboratory units will be required for a junior-senior high school with an enrollment of 900 pupils in grades 7-12?

Grade	Number Pupils	Number Boys	Number in Shop	Number Classes
7	200	100		5 (18 weeks)
8	200	100		5 (18 weeks)
9	200X	30%	60	3
10-12	300X	15%	45	2

Total Number of Periods: 10 (2 laboratory units required).

The following recommendations and facility layout are intended as a guide to planning industrial arts facilities.

A. Size, Shape and Location

Total minimum floor area for shop laboratories, drafting rooms, classrooms, storage and finishing areas should be not less than 3,500 square feet. Of this total area, not less than 2,200 square feet should be used as a shop laboratory. A drafting room and electricity-electronics room should have not less than 850 square feet in each space.

Shop laboratories should be located on or above ground level and the floor space of shop laboratories should be on one level. Shop laboratories should be located where noise will cause the least interference to the rest of the school. A wing of the main building or a separate building near the main building is preferred.

A laboratory area, square or rectangular in shape, not exceeding a ratio of 1 to 2, is best. Avoid recessed areas, "L" and "T" shapes. All parts of the shop should be visible to the instructor.

Ceiling height should be at least 10 feet in laboratories (shops) when dust collectors are provided for wood machines; at least 12 feet without dust collectors.

The shop should not be a passage-way to other rooms. Each shop should be an integral unit.

The facilities should be designed so that additional laboratories, drafting rooms and classrooms could be added with a minimum of expense.

B. Walls, Floors and Ceilings

Drafting, planning and electricity-electronics room floors should be covered with tile. It is recommended that shop laboratory floors be covered with a non-skid tile. Colored concrete floors are generally satisfactory if finished smooth, hardened and sealed.

Conduit for machines should be laid before the floor is poured and allowed to terminate flush with the floor level with covered outlets at predetermined machine locations. Wall raceways containing 220-V 3 phase, 220-V single phase, and 110-V service should be provided as they permit flexibility in organizing or relocating machines and should provide sufficient power so that all machines can be operated at one time. Every outlet should be a grounded outlet. A magnetic control switch should be located for easy access - preferably near the office. This should be a part of the control system. Each machine circuit should be individually protected with a circuit breaker.

Walls should have a smooth finish. A wainscoting approximately 48" high and of a durable nature should be provided.

Provide glass (transparent) panels in partitions between shops and auxiliary rooms. Safety glass with wire mesh located in doors to auxiliary spaces will be satisfactory.

Partition walls should be non-bearing walls ceiling heigh and of a semi-permanent construction to permit future alterations in floor plan.

Ceiling should be acoustically treated or possess sound-absorbing qualities.

C. Windows and Doors

Window area should be approximately 20% of floor area. Use sash of the awning type when possible.

Windows should extend to the ceiling from a point 5' to 7' above the floor to permit more effective use of wall space. Where activities outside the building might interfere with shop classes, window sills should be above eye level. Select a northern exposure. Prismatic skylights, oriented northward, are effective.

Sunlight must be controlled, preferably before entering the shop, by means of overhanging roof or louvered reflectors. This is especially important in warm climates. Make provision for darkening certain areas for use of films and TV.

Provide only one door as the regular means of pupil entrance. Shops should have a 5'-6' double door opening onto a service drive. Door locks within a shop should have a master key.

D. Illumination and Painting

A minimum of 30 foot candles at bench height should be provided in shops and a minimum of 50 foot candles in drafting and electricity-electronics laboratories. Local lighting should be provided where necessary. Secure the advice of lighting experts.

Semi-direct types of fixtures are satisfactory for shops. Diffused light is preferred. Fluorescent lighting used in and near an electronics shop should be furnished with a radiation filter to prevent interference with electronic equipment.

Light switches should be located near the main entrance to shops and drafting rooms. The lighting circuit should be separate from circuits for machines and wall convenience outlets.

Ceilings and walls should be painted with a flat, high reflection factor paint. Ceiling should be white with a reflection factor of 85% or above. Upper walls should be of a suitable color and with a reflection factor of 60%. Wainscoting should have a reflection factor 40 - 60%. Equipment in the shop should be painted to carry out a color scheme. Color schemes are available from paint manufacturers.

E. Equipment

Provide aisles of travel to commonly used areas. Insure that ample space exists around equipment, but do not distort the most effective arrangement for the occasional extra large piece. Locate machines so that operational procedures do not endanger others.

Machines used in sequential order should be arranged in the order of their operation. Machines should be mounted on celotex or leather and bolted to the floor sufficiently to keep them in position.

Locate the most frequently used equipment near the center of operation. Cut-off saws for wood and metal should be located near the storage rooms. Within a shop, locate related areas together, i.e., welding, forging, foundry, etc.

Utilize naturally lighted areas for precision equipment such as lathes, drawing tables, grinders, saws, etc., and consider direction of light with reference to operator position.

Allow sufficient floor space for assembly and demonstration areas.

Provide dust and shaving collectors for machines and exhausts for gases and fumes. Glazed terra-cotta tile under the floor works well. Shaving collectors should be outside of the shop.

Electrical service to machines should be controlled from a panel conveniently located in the shop. Extra circuit breakers should be provided for future additions.

Tools and equipment should be purchased with the sizes of the pupils in mind. Purchase high quality equipment, preferably of medium rather than light weight. Purchase only self-contained machines, not combination machines. Never run two or more machines from the same motor.

Planning and library centers should be located in an auxiliary room separated from the work area by a glass partition. Lighted display cabinets or cases should be provided outside of but near the working area of the shop.

Lumber and metal bar stock, band iron, etc., may be stored in vertical bins with a resulting economy of space. Consider standard sizes of materials when planning storage.

F. Other Considerations

Provide adequate storage space for student projects, supplies. Provide adequate chalkboard and bulletin board space.

Provide a four station wash area, goose neck fixtures, and hot and cold water in each shop lab. Provide drinking fountain and slop sink in shop area. Provide toilets if building is detached from other school building.

Water, gas, and compressed air (80 - 100 lbs.) should be provided. Air compressors should be located outside the shop area and at least 25' from the nearest spray painting outlet. Air lines should pitch back to the compressor. Provide finishing room with dry type spray booth and regulated compressed air.

Locate convenience outlets in the walls of the shop at 10-12' intervals and at work benches. Wall outlets should be 42" above the floor. Outlets for soldering irons and other heating devices should be equipped with pilot lights.

Unit type heaters mounted near the ceilings are generally suitable. Heating and cooling controls for shops should be separate from the central control system for the rest of the school. Air conditioning should be provided; if not, fans of sufficient size to

properly ventilate the facilities should be provided. The fans may be located in the ceiling or on an outside wall.

A sounding unit of the school fire alarm and period change systems should be installed in each shop. Provide appropriate fire extinguishers and first aid cabinets.

Provision should be made for storage of cleaning equipment on an organized basis.

A signal bell operated independently in the shop laboratory should be provided.

G. Planning Individual Laboratories

When the kind of laboratory facilities has been determined, the detailed floor plan and equipment locations should be developed. This planning should be a joint effort by the principal, industrial arts teacher, local supervisor, architect, and industrial arts consultant of the Georgia Department of Education.

H. Reference Sources

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III. Modern School Shop Planning, Prakken Publications, Ann Arbor, Michigan, 1965.

IV. Let's Look at Modern Industrial Arts, E. H. Sheldon Equipment Company, Muskegon, Michigan, 1958.

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I. Consultant's Services

State Consultant for Industrial Arts Education
Georgia State Department of Education
313 State Office Building
Atlanta, Georgia 30334

MINIMUM INDUSTRIAL ARTS FACILITY FOR SCHOOL ENROLLMENT OF 750

RECOMMENDED LAYOUT

EQUIPMENT INDEX FOR INDUSTRIAL ARTS FACILITY

1. Teacher's desk.
2. Layout table.
3. Tracing table.
4. Drafting tables, dual type with storage; if tables without storage are purchased additional storage cabinets will be needed in rear of room.
5. Stools, drafting.
6. Sink enclosed with storage cabinets below and work surface above for reproduction equipment. 110-V outlet 36" above floor level.
7. Chalkboard, 16 ft., bottom located at least 36" from floor level.
8. Tack board, 16 ft., bottom located at least 40" above floor level.
9. File cabinet, legal size.
10. Electrical tables with storage below and power supply mounted on top, 110-V electrical connection in floor for each.
11. House and industrial electrical work area, locker storage below, three 110-V outlets 36" above floor level, one 220-V outlet.
12. Tool panel, electrical tools.
13. Fire extinguisher, appropriate type as located.
14. Small motors work surface with storage cabinets below, 110-V outlets 36" above floor level along the wall.
15. Electroplating work area, 110-V outlets, 36" above floor level.
16. Electronics test area with storage cabinets below, four 110-V duplex outlets along wall 36" above floor, one 220-V outlet 36" above floor.
17. Demonstration panel, 110-V outlets 36" above floor level.
18. Coat rack with book storage shelf above.
19. Display case with glass front and light inside, outlet needed.
20. Water fountain, 110-V outlet.
21. Chalkboard, 8 ft., 36" above floor level.
22. Wash area with four wash faucets with hot and cold water, storage below for janitor supplies.
23. Tack board, 4 ft. long, 36" above floor level.
24. Planning table.
25. Book shelves.
26. Finishing area complete with spray booth, compressed air outlet, exhaust fan and hood, and work surface.
    Finishing room may be relocated after consulting the State Consultant for Industrial Arts, State Department of Education.
27. Exhaust fans located high on the wall (May be located in roof) are required for ventilation if facility is not air conditioned.
28. Broom rack with trash can below, provided in locations as shown on plan.
29. Metal spinning lathe, 220-V, 3 ph.
30. Metal lathe, 220-V, 3 ph.
31. Milling machine, 220-V, 3 ph.

32. Soldering table, three 110-V outlets 36" above wall.
33. Spot welder, 220-V 3 ph outlet 36" above floor level.
34. Gas furnace, natural gas outlet and 110-V outlet.
35. Foundry work bin.
36. Furnace, crucible, natural gas outlet and 110-V outlet.
37. Heat treating furnace, natural gas outlet.
38. Welding table for arc welder, 220-V outlet in back wall, exhaust fan and hood over welding area.
39. Welding table, gas, exhaust and hood above welding area.
40. Power mechanics work area, three 110-V outlets 36" above floor level.
41. Work table, metal, 42" x 96" with 2 stake plants, lockers below.
42. Work bench, metal, 42" x 96" with storage shelves below for sheet metal and combination machine, bar folder, and finger brake mounted on top.
43. Drill press, 220-V, 3 ph.
44. Metal shaper, 220-V, 3 ph.
45. Power hacksaw, 220-V, 3 ph.
46. Squaring shear, no power needed.
47. Grinder, 220-V, 3 ph.
48. Work bench, 36" x 6 ft., with lockers below.
49. Slip form roll, floor mounted.
50. Tool panel for metal working tools, lock type.
51. 4-station wood work bench, complete with 4 vises, storage lockers below, 110-V outlet dropped from above table to 4 ft. above floor line.
52. Wood shaper, 220-V, 3 ph., connected to dust and chip system.
53. Belt and disc sander, 220-V, 3 ph, connected to dust collector system.
54. Bandsaw, 220-V, 3 ph, connected to dust and chip system.
55. Overarm saw, 220-V, 3 ph, connected to dust and chip system.
56. Tilting arbor saw, maximum size 10", 220-V, 3 ph, connected to dust and chip system.
57. Wood surfacer, 220-V, 3 ph, connected to dust and chip system.
58. Jointer, 6-8", 220-V, 3 ph, connected to dust and chip system.
59. Lumber rack, vertical.
60. Wood lathe, 220-V, connected to dust and chip system.
62. Portable glue table.
63. Clamp rock.
64. Tool storage, woodworking tools, lock type.
65. Recommended location for power panels; may be relocated.
66. First aid cabinet.
67. Dust and chip collector unit, adequate wiring for unit installed; may be relocated.
68. Air compressor, adequate wiring for unit installed; may be relocated; pipe air to finishing room and provide at least one additional outlet in shop area as marked.
69. Floor openings for dust collector system for cleaning floor. Make provisions for closing and opening hole.
70. Clock outlet, 8 ft. above floor level or other appropriate location.
71. Location for push button for clean up buzzer. Clean up buzzer should be located on inside wall directly above switch.

72. Storage racks for power mechanic parts, etc.
73. Metal bender.
74. Electrical table stools.
75. Teachers coat rack.
76. Storage cabinets, small supplies.
77. Mirror, bottom 48" above floor.

Notes: (1) Windows are not shown in plan since size and type will depend on architectural design. Window sills should be from 5-7 ft. above floor level.
(2) Exhaust pipes for dust and chip collector should be under floor.
(3) Office and small storage rooms can be deleted and toilets added in this space if unit is detached.
(4) Skylights may be used for natural light in shop laboratory.
(5) Doors opening into laboratory should have polished wire glass in upper half of door.

GEORGIA COUNTIES AND CONGRESSIONAL DISTRICTS